

Corneal Drawings: An Important Tool in Documentation

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ABSTRACT

Schematic diagrams have been an important tool in ophthalmology for a long time. Corneal drawings help record and monitor corneal pathologies. These aid in comparing the clinical course of disease on follow-up visits and act as standardised means of communication between Ophthalmologists globally. They are essential for teaching postgraduates and are also useful in medicolegal cases. The corneal pathologies are documented in both frontal view and cross-sectional (slit) view. There is a universally accepted set of six colour codes for portraying them, namely, red, blue, black, brown, green and yellow. This method of documentation is economical, easy and gives an instant impression at a glance. This article primarily focuses on the origin, evolution, and standardised colour-coding and depiction of corneal pathologies, presented as schematic diagrams that can serve as a reference for all Ophthalmologists in their routine clinical practice.

Key words: Colour-coding; cornea; corneal drawings; schematic diagrams.

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INTRODUCTION

Documentation is vital for good clinical practice as well as the delivery of quality health care (Mishra et al., 2022). It should be updated from time to time as the patients need access to their clinical condition records (Mathioudakis et al., 2016). The use of schematic diagrams in clinical science dates to the Hippocratic era. This schematic documentation not only helps in monitoring the disease over time but also standardises medical records and management (Grammaticos et al., 2016). It is a good aid for postgraduate teaching (Mishra et al., 2022). Proper and accurate documentation acts as a safeguard against medicolegal cases (Lorenzetti et al., 2018). The colour-coded diagrams of the cornea make the correlation of the clinical findings easier at follow-up visits. They delineate the lesion's size, extent and location (Tobore et al., 2019). This article is an attempt to summarise the standardised colour-coding system along with corneal drawings. It will also throw some light on the history and evolution of corneal drawings.

History and Evolution of Corneal Drawings

The origin of the standardised colour-coded diagrams in Ophthalmology dates back to the year 1969, when Dr. Charles L. Schepens, the father of modern retinal surgery, devised a system for fundus drawings (Schepens et al., 1969).

Later on, in 1973, A.J. Bron described a simple notation for drawing corneal pathologies for the first time in history. The cornea was depicted by a circle in the plane view. The limbal follicles, infiltrates and vessels of the limbal palisades

were drawn outside this circle, and vessels drawn within the circle were to be interpreted as pathological. The pupil was shown by a circle drawn with dashed lines (Figure 1). A simple scheme of Bron's documentation has been shown (Figure 2). The abbreviations used to indicate the level of the pathology and the location of a particular change in the stroma were noted (Table 1). The individual features were denoted by the initial letters (Table 2). The degree of severity of oedema, infiltrate, scarring and abscess were denoted on a scale of 1-4 in increasing order of severity. Keratic precipitates were depicted as small circles and annotated as K.P. The colour codes used by him are tabulated (Table 3)(Bron et al., 1973).

The major drawback of this system of schematic documentation was its inability to depict the change from severe infiltrate to abscess. Identifying oedema and scars was also difficult (Bron et al., 1973).

In 1977, George O. Waring III attempted to overcome these shortcomings. He used colour-coded frontal and slit views of the cornea. For the frontal view, a circle of diameter 35 mm was drawn, which represented the limbus. The pupil served as a landmark for localising the pathologies. He used the colour code as tabulated (Table 4). A slit view was drawn to depict the exact level of scar, oedema and infiltrate. It was used to represent changes in corneal thickness due to anterior ulceration, the posterior bulge of stromal oedema or diffuse thinning, changes in the lens, keratic precipitates, etc., (Waring et al., 1977).

In 1985, Rao and Aquavella et al., modified Waring's method of schematic representation

(John et al., 1986). They had added the outline of the eyelids to the slit view diagram of the cornea to represent the condition of the eyelids, tear film and other anterior segment changes. The frontal view of the cornea was divided into four quadrants by G.N. Rao and James Aquavella (Figure 3)(John et al., 1986)

Dr. Jens Bühren et al., devised a standardised drawing scheme for documenting the changes in the cornea post-refractive corneal surgeries in the year 2006. He used the colours (Table 5) to depict these corneal changes (Bühren et al., 2006).

The important developments in corneal drawings have been summarised (Table 6).

Drawing the corneal diagrams

Prerequisites:

All these schematic diagrams of the corneal pathologies are drawn on paper only after performing a thorough slit lamp examination of the patient's eyes. We need a slit lamp, eraser, stencils or circular objects and colour pencils. Currently, six colours are used to depict corneal pathologies: black, blue, brown, red, yellow, and green (Cosar et al., 2018). The pathology/features they are used to depict have been listed (Table 7).

Firstly, the front view of the cornea should be drawn, followed by the slit view for depicting the pathologies in both views. Then, vital stains

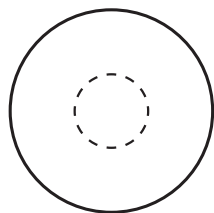


Figure 1: Plane view of the cornea with pupil.

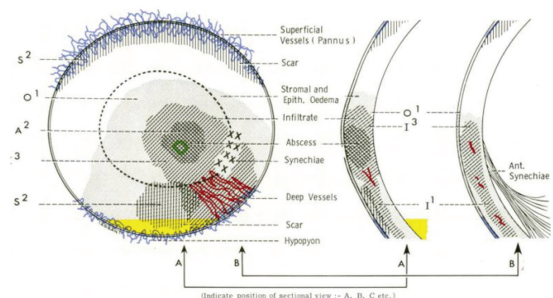


Figure 2: Picture courtesy: “A simple scheme for documenting corneal disease”, AJ Bron, British Journal of Ophthalmology 1973, vol. 57, pg.-629-634.

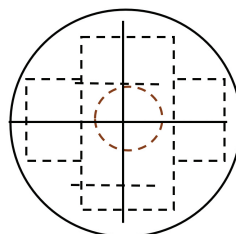


Figure 3: Rao and Aquavella 's depiction of cornea .Cornea is divided into four quadrants connecting 6 and 12, and 9 and 3 o' clock positions. Each quadrant is further subdivided by discontinuous lines joining the remaining clock hours Pupil is drawn in the centre.

Table 1: Bron's abbreviations.

Level of pathology	
Epithelium	Ep.
Stroma	Str.
Descemet's membrane	Des.
Endothelium	End.
Location of a particular change in the stroma	
Anterior	A
Middle	M
Posterior	P

Table 2: Initial letters in Bron's documentation.

Corneal oedema	O
Corneal scarring or opacity	S
Corneal infiltrate	I
Corneal abscess	A
Corneal thickness	T followed by decimal fraction of normal thickness

Table 3: Colour coding used by A.J. Bron (Bron, 1973)

Red	Deep vessels, Rose Bengal staining
Green	Fluorescein staining
Blue	Superficial vessels
Yellow	Hypopyon
Black	Corneal outline, pupil, synechiae, scar, infiltrate

Table 4: Colour coding used by George O. Waring.

Black	Limbus, corneal degeneration, scar, droplet- keratopathy, contact lens, sutures
Brown	Pupil , epithelial iron lines, Krukenberg spindles, epithelial melanosis
Green	Fluorescein staining (epithelial defects)
Orange	Corneal infiltrate, keratic precipitates, hypopyon
Red	Superficial blood vessels, deep vessels, ghost vessels, hyphema, Rose Bengal staining
Blue	Epithelial oedema (microcysts and bullae), stromal oedema, Descemet's membrane folds

Table 5: Jens Buhren's colour codes for depicting post-refractive surgery corneal changes.

Red	Incisional surgery changes (e.g., radial keratotomy, astigmatic keratotomy)
Blue	Coagulative procedures(e.g., laser thermokeratoplasty, conductive keratoplasty)
Green	Surface ablation changes(e.g., photorefractive keratectomy, laser subepithelial keratomileusis, epi.- LASIK)
Yellow	LASIK- related corneal changes
Black	Corneal outline in both frontal and slit view

Table 6: Important developments in the corneal drawings.

A. J. Bron (1973)	A simple scheme for documenting corneal diseases He had used abbreviations for labelling the depth of pathology and letters a, m and p for anterior, middle and posterior stroma respectively and initial letters for labelling individual features like O for oedema , S for scar etc. and graded them from 1-4 depending upon the severity.
George O. Waring III (1977)	Frontal view of cornea: circle of diameter 35mm and slit view to depict the pathologies He had used 6 colour codes- black, brown, red, orange, green and blue.
Rao and Aquavella et al.(1985)	Frontal view of cornea divided into four quadrants.
Dr. Jens Bühren et al. (2006)	Drawing scheme for documenting the changes in the cornea post- refractive corneal surgeries.

Table 7: Standardised colour codes for corneal schematic diagrams currently used.

Black	Corneal Scars, corneal degenerations, corneal dystrophy, corneal foreign body, sutures, contact lens, band shaped keratopathy, limbus, opacity, corneal guttata, tissue adhesive, corneal nerves, Vogt's striae
Blue	Diffuse stromal oedema (shading), epithelial oedema(small circles), folds in descemet's membrane (wavy lines) and epithelial bulla (omega- on slit view)
Brown	Epithelial iron lines, epithelial melanosis, old keratic precipitates and krukenberg's spindles, pupil, synechiae
Red	Blood vessels, Rose Bengal staining(dots), ghost vessels (straight dotted lines), haemorrhage
Yellow	Hypopyon, infiltrates and fresh keratic precipitates
Green	Filaments (lines), superficial punctate keratitis (dots), epithelial defect(shades), fluorescein staining

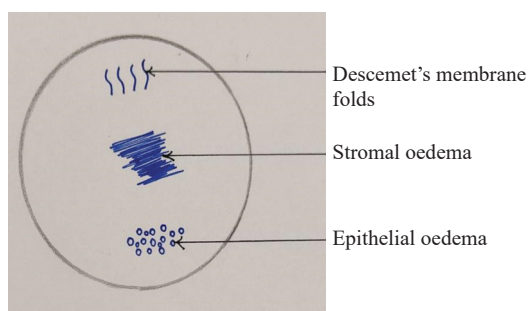
like Fluorescein or Rose Bengal should be used. This should be followed by the depiction of the stain-positive areas (if any) and the measurement of the pathologies. The clock hour rule should be followed to show the exact location of the pathology.

The use of colour code for different lesions/ pathologies in the cornea has been depicted by hand-drawn diagrams using colour pencils/

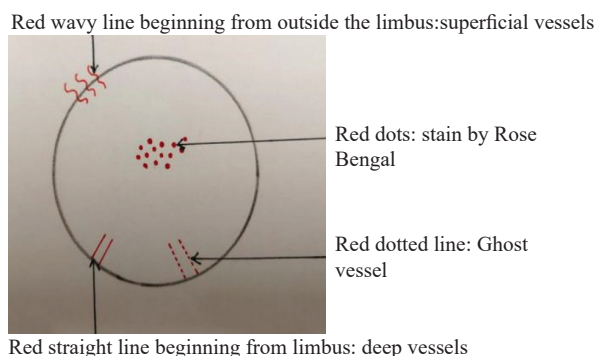
sketch pens in Figure 4 (A, B, C, D, E, and F).

The slit view of the cornea on a slit lamp and the delineation of epithelium, stroma and endothelium is shown (Figure 5). A hand-drawn depiction of the slit view of the cornea and how certain pathologies are depicted in the prescribed colour code (Figure 6). A series of clinical pictures and their hand-drawn, colour-coded depiction has been shown (Figure 7).

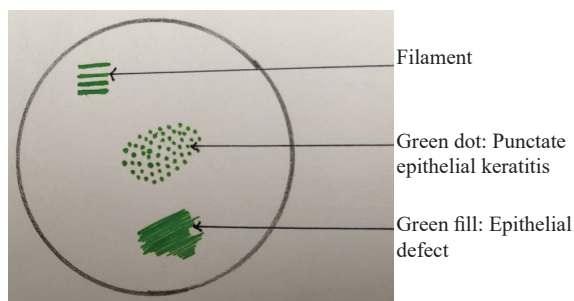
Figure 4: Corneal colour-coding



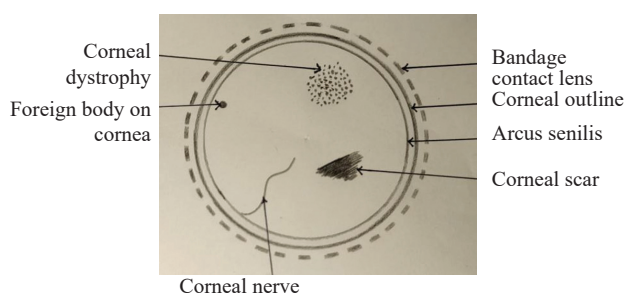
4A: BLUE: Hand-drawn using coloured pencil and sketch pen



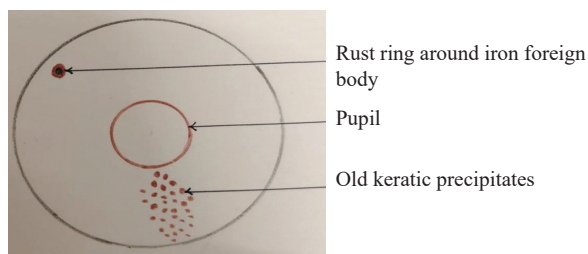
4B: RED: Hand-drawn using coloured pencil and sketch pen



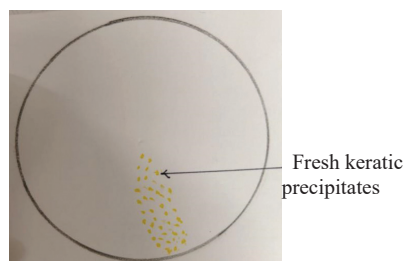
4C: GREEN: Hand-drawn using coloured pencil and sketch pen



4D: BLACK: Hand-drawn using coloured pencil and sketch pen



4E: BROWN: Hand-drawn using coloured pencil and sketch pen;



4F: YELLOW: Hand-drawn using coloured pencil and sketch pen;

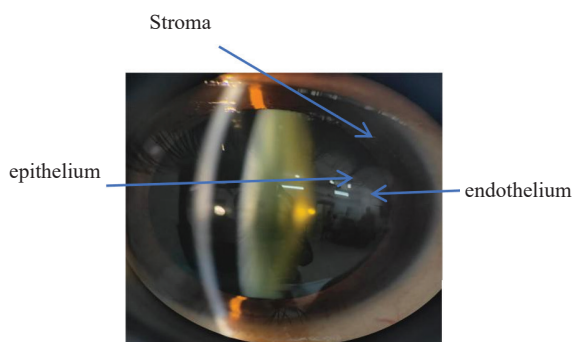


Figure 5: Slit section of the cornea showing epithelium, stroma and endothelium.

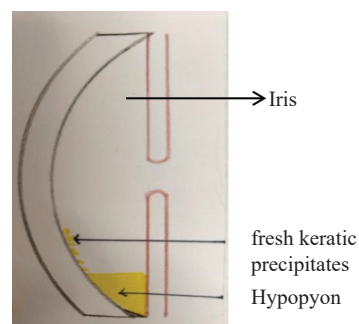


Figure 6: Slit view of cornea: hand-drawn using coloured pencils.

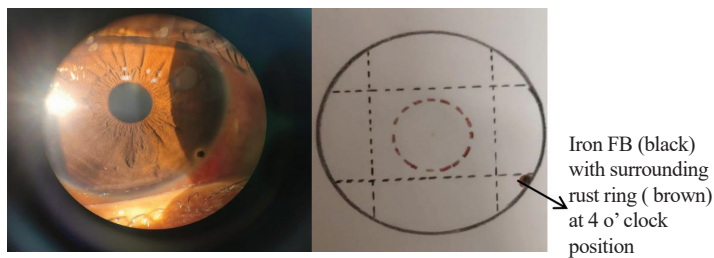


Figure 7A: Iron foreign body (FB) surrounded by rust ring at 4 o'clock position.

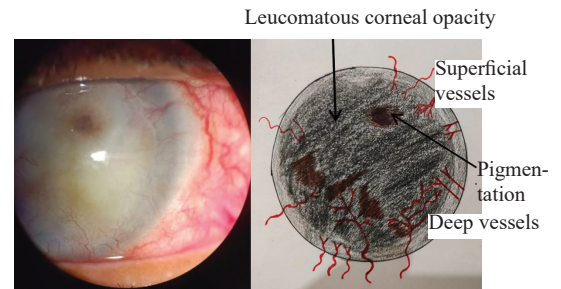


Figure 7B: A leucomatous corneal opacity with vascularisation and surface pigmentation.

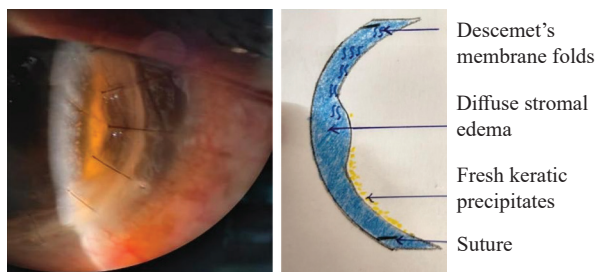


Figure 7C: Endothelial rejection in a penetrating corneal graft.

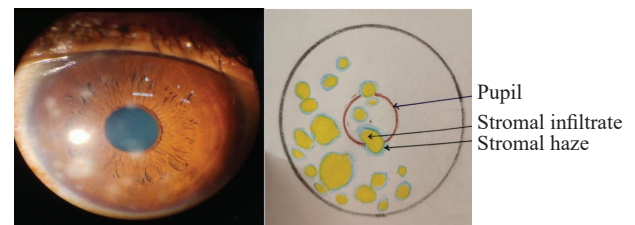


Figure 7D: Nummular stromal lesions.

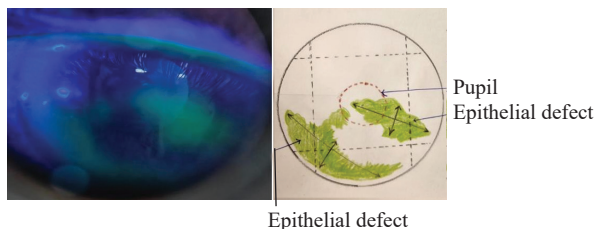


Figure 7E: Corneal epithelial defect.

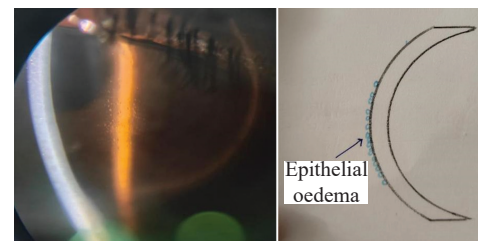


Figure 7F: Microcystic corneal epithelial oedema.

CONCLUSION

In conclusion, cultivating the practice of systematically illustrating corneal pathologies should be strongly encouraged in ophthalmic practice. Such drawings serve not only as a valuable adjunct to clinical documentation but also as important medicolegal records that can accurately reflect disease morphology and progression. Beyond their role in

guiding diagnosis and management, corneal illustrations function as powerful educational tools, facilitating clearer communication, reinforcing clinical understanding, and enhancing the teaching of trainees and future generations of ophthalmologists. Ultimately, this practice fosters greater observational skills and contributes to the development of more reflective, precise, and effective clinicians in the field of ophthalmology.